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# How to deploy delta-neutral liquidity in Uniswap — or why Euler Finance is a game changer for liquidity providers

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*TL;DR:*

- *Providing liquidity in Uniswap is limited to taking directional positions with "positive delta." This means LPs will not benefit from participating in bearish token pools.*
- *Protocols like Euler Finance allows users to incorporate short positions into their strategies.*
- *Combining a short position with Uniswap v2 or v3 LP tokens unlocks neutral and bearish strategies for liquidity providers (LPs).*

- *It's a Win-Win-Win scenario:*
  1. *LPs can deploy directionally strategic positions on Uniswap.*
  2. *Uniswap traders benefit from evenly distributed liquidity in all pools.*
  3. *Depositors earn more yields on Euler due to the Uni LP borrowing use case.*

- *Tools/calculators in this post:*
  *-Uni v2 LP hedging: https://www.desmos.com/calculator/pkscywsiiw*
  *-Uni v3 LP hedging: https://www.desmos.com/calculator/669zg1rmvb*

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## Bearish Assets and Uniswap LPs

In Uniswap, liquidity providers (LPs) benefit the most from participating in pools for which the token price increases over time. That's because digital assets will be sold as the price increases, which results in a net positive P&L when denominated in ETH or stablecoin.

What happens when a token price decreases instead? Since LPs lock tokens at a 50:50 ratio in Uniwap v2, any price decrease results in the liquidity provider *purchasing* more tokens. This would constitute a net loss by the time they exit their liquidity position (although not as large as holding the token).

**Thus, the optimal behavior for LPs is to withdraw all assets from bearish pools and swap the assets to ETH or stablecoin in order to protect their portfolio's value.**

Let that sink in: LPs should only participate in pools with tokens for which they hold a bullish outlook. Any token with a bearish or even neutral outcome will be a net loser.

That's perhaps why liquidity mining (LM) incentives are necessary for many tokens to attract liquidity. It's easy to see, however, that LM will lead to the price spiraling down due to a selling feedback loops:

→ price goes down
→ LPs leave pool

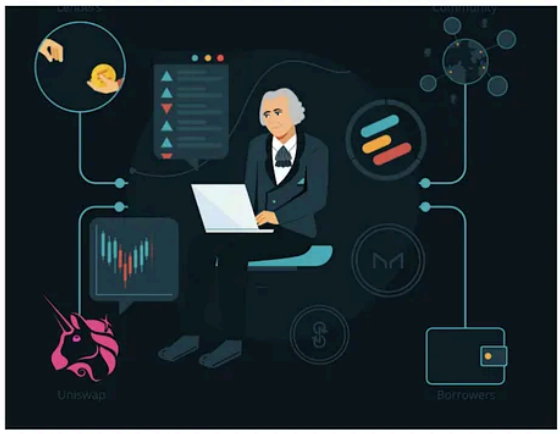
→ protocol issues LM incentives to attract more liquidity
→ LPs receive rewards
→ LPs sell tokens
→ price goes down → LPs leave pool…

How can we resolve this? As an alternative to relying on liquidity mining for profitability, liquidity providers should have the opportunity to provide liquidity with a *borrowed asset* instead of buying it outright.

Shorting an asset can be used to create bearish and delta-neutral LP positions in Uniswap v2 and v3. In addition, borrowing a token instead of buying it will 1) have no impact the price of that asset and 2) act as a form of leverage.

In this article, we will show how all of this is now possible thanks to the recent launch of Euler Finance.

## Euler Finance Basics




Euler Finance is a protocol that aims to enable on-chain lending and borrowing of *any* asset on the Ethereum blockchain:

> *(Euler is) a permissionless lending protocol custom-built to help users lend and borrow more Ethereum-based tokens than ever before. The purpose of this white paper is to describe how Euler works at a high level and highlight new features and innovations that help to set it apart from other popular lending protocols, like Compound and Aave.*
> *Source: Euler Finance whitepaper*

Why is this a game changer? Basically, Euler Finance enables the borrowing of any tokens as long they are traded on Uniswap v3 (as opposed to permissioned listing in Aave/Compound/etc):

> *Permissionless Listing: Euler lets its users determine which assets are listed. To enable this functionality, Euler uses Uniswap v3 as a core dependency. Any asset that has a WETH pair on Uniswap v3 can be added as a lending market on Euler by anyone straight away. Source: Euler Finance whitepaper*

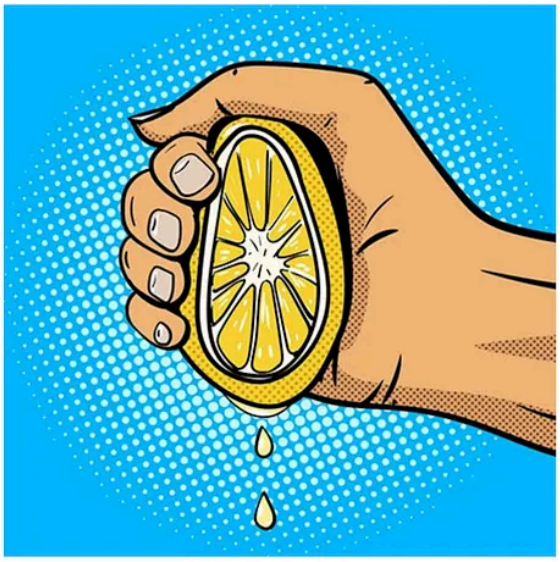
In addition, Euler finance "uses risk-based asset tiers to protect the protocol and its users". See this section of the Euler docs for a detailed description of how each asset is categorized. In a nutshell:

- Assets with the lowest risk will be in the ***collateral-tier***. Multiple assets in the cross-tier can be borrowed at the same time, and only these assets can be used as collateral. *Assets: WETH, WBTC, USDC, DAI, DeFi blue chips.*
- Slightly safer assets will be in the ***cross-tier***. Multiple assets in the cross-tier can be borrowed at the same time, but these assets cannot be used as collateral either. *Assets: medium-to-high market cap tokens with established use cases but uncertain long-term stability prospects.*
- The riskiest assets will be in the ***isolation-tier***. Only a single asset in the isolation-tier can be borrowed at a time and these assets cannot be used as collateral. *Assets: All other assets, which are in the isolation-tier by default.*

Therefore, the permissionless nature of borrowing and lending in Euler Finance should unlock a much wider variety of assets than Aave and Compound.

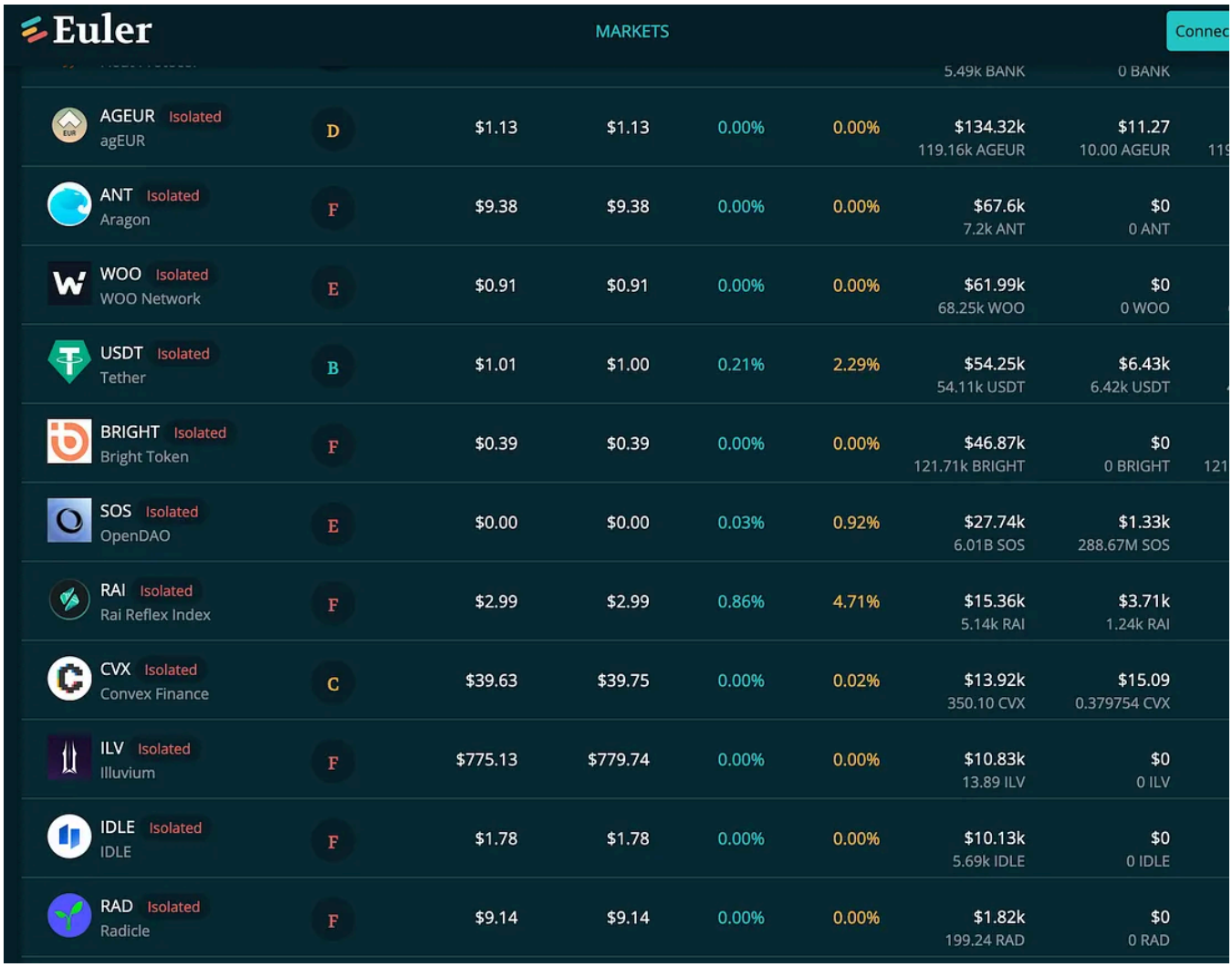
At the same time, Euler's risk framework aims to maximize borrowing+lending activity while minimizing the probability of bad debts and oracle manipulation. This makes Euler Finance inherently safer than Rari Capital's Fuse platform and a more vibrant lending platform than Sushiswap's Kashi. And the reliance on trustless and hard-to-manipulate Uniswap v3 oracles also makes Euler Finance more secure than on-chain perpetual protocols.

## Using Euler Finance to Short Tokens



Euler Finance was deployed on Mainnet on Dec. 13 2021, and we can already see that several assets are available to lend+borrow. Predictably, most stablecoins and blue chip tokens are available and have already attracted significant activity.

Where Euler Finance really shines, however, is in the long-tail of assets that are currently unavailable to borrow on Aave and Compound. For instance, several tokens in the isolated-tier are available to borrow at very low APY:




Why would someone borrow ANT, WOO, SOS, or CVX tokens? In fact, why do we care about borrowing *any* tokens at all?

**Borrowing a token and selling it for ETH or stablecoin enables traders, investors, funds, and DAO treasuries to permissionlessly short an asset.**

Shorting has a bad rap, especially considering that many TradFi institutions allow naked shorting and other shenanigans. Shorting an asset, however, does not necessarily mean that the short seller wishes the token to go to zero. Instead, shorting an asset can be used to control portfolio risk and, in the context of Uniswap LPing, it can be used to create delta-neutral or even bearish LP positions. Here's how that works.

## Hedging in Uniswap v2 using Euler Finance

Modern hedging, using yew (Taxus Baccata)

When deploying liquidity in a constant X*Y= k AMM like Uniswap v2 and Sushiswap, users must deposit tokens into the pool so that the value of each token is the same (50:50 ratio).

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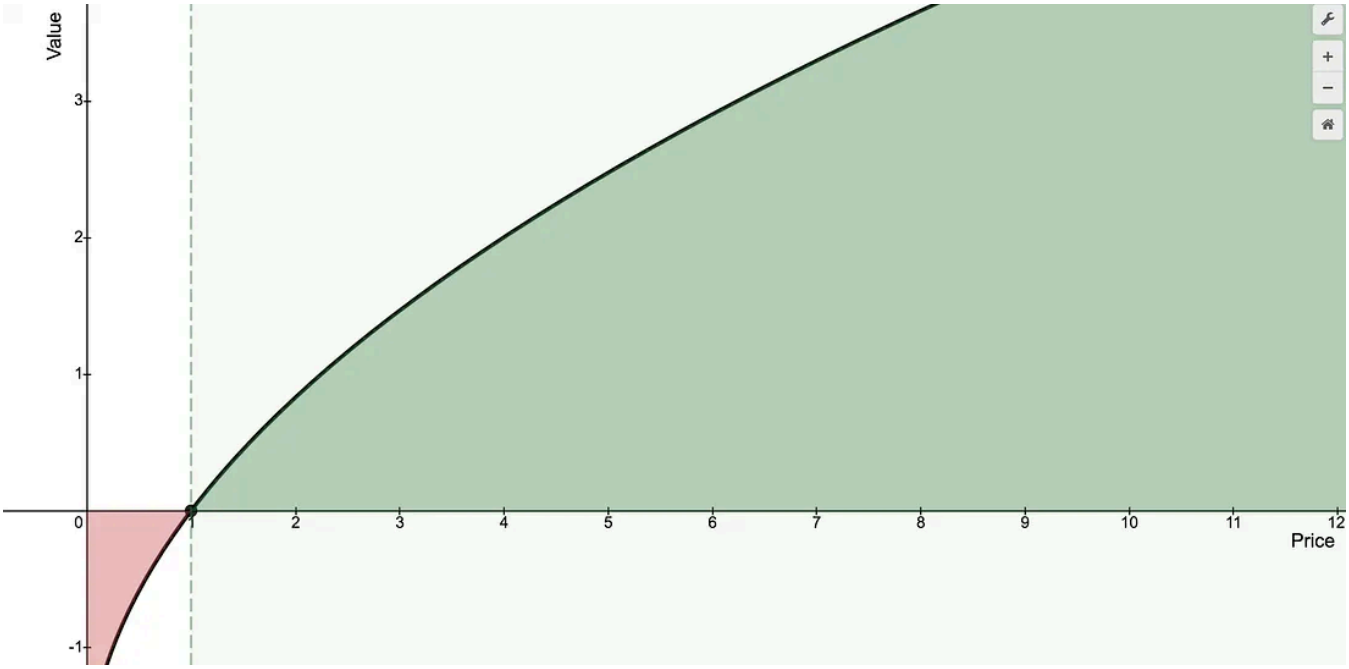
Let's assume that the Y token is the ***numéraire***, which will be stablecoin in a stablecoin-token pair or ETH in a ETH-token pair. The X token will be the ***asset***. Following the derivation from Peteris Erins' post, we can compute the value of an LP position in term of the numéraire if it was deployed at price $S_0$ and the current price is S as:

$$V(S) = 2L\left(\sqrt{S} - \sqrt{S_0}\right) + F, \text{ where: } \begin{cases} S_0 = \frac{Y_0}{X_0} \\ L = \sqrt{X_0 \cdot Y_0} \\ F = \text{Accumulated fees} \end{cases}$$

The value of the LP position in terms of the numéraire thus depends on the square root of the price:




Value of a LP position in terms of the numéraire. Green shaded regions represent profitable price ranges.

Now comes Euler Finance: instead of being fully exposed to both assets, one may wish to borrow one of the assets to hedge their position. If one were to borrow H tokens of the X asset, then the value of the LP position is simply:

$$V(S) = 2L\left(\sqrt{S} - \sqrt{S_0}\right) - H\left(S - S_0\right) + F$$

If we compute the delta of this expression, which represents how much the value of the LP position will change in response to a small change in price, we get:

$$\delta(S) \equiv \frac{dV}{dS} = \frac{L}{\sqrt{S}} - H$$

Note that the value of delta is alway positive if the hedge amount H is equal to zero. This means that LP positions will always increase/decrease in value when the price of the asset increases/decreases .

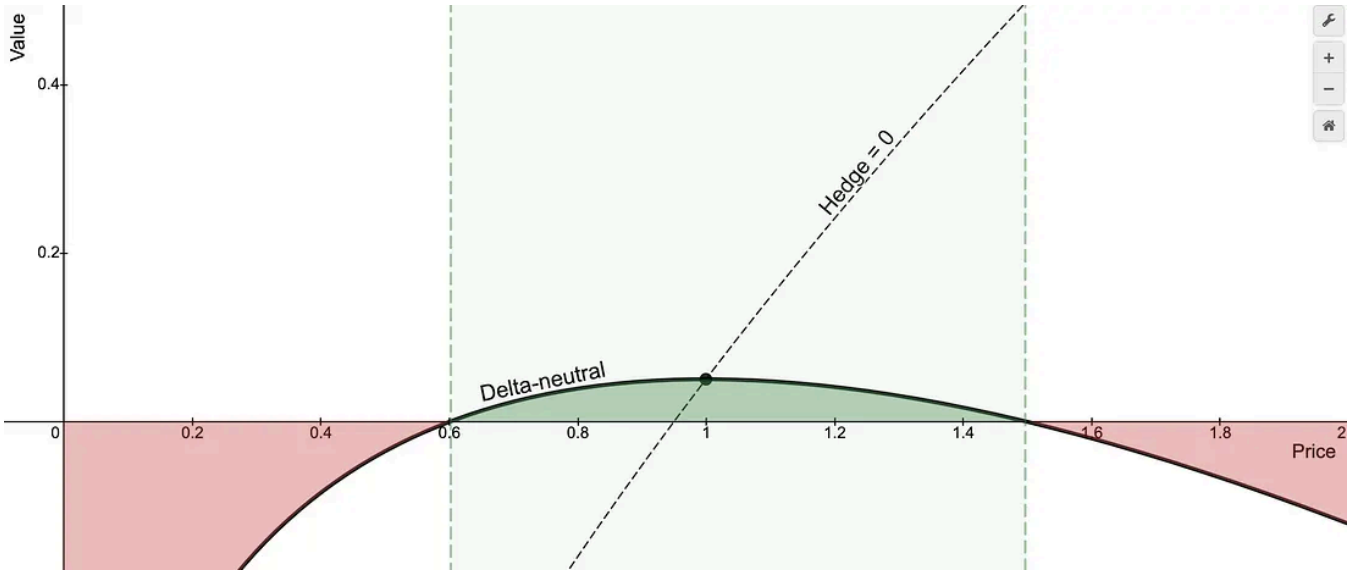
LPs that hold a neutral or even bearish outlook on a token may wish to maintain a “delta-neutral” position that will not be sensitive to changes in the price of the underlying S.

We next compute how many tokens need to be borrowed (ie. shorted) in Euler Finance as:

$$\delta(S_0) = 0 \rightarrow H = \frac{L}{\sqrt{S_0}} = X_0$$

Concretely, this means that a delta neutral position in Uniswap v2 is realized by **borrowing 100% of the asset** and locking the same value of numéraire token. For instance, a delta-neutral ETH-UNI LP position could be implemented by borrowing 200 UNI tokens and locking them with 1 ETH in the ETH-UNI Uni v2 pool (current price = 0.005 ETH/Uni).

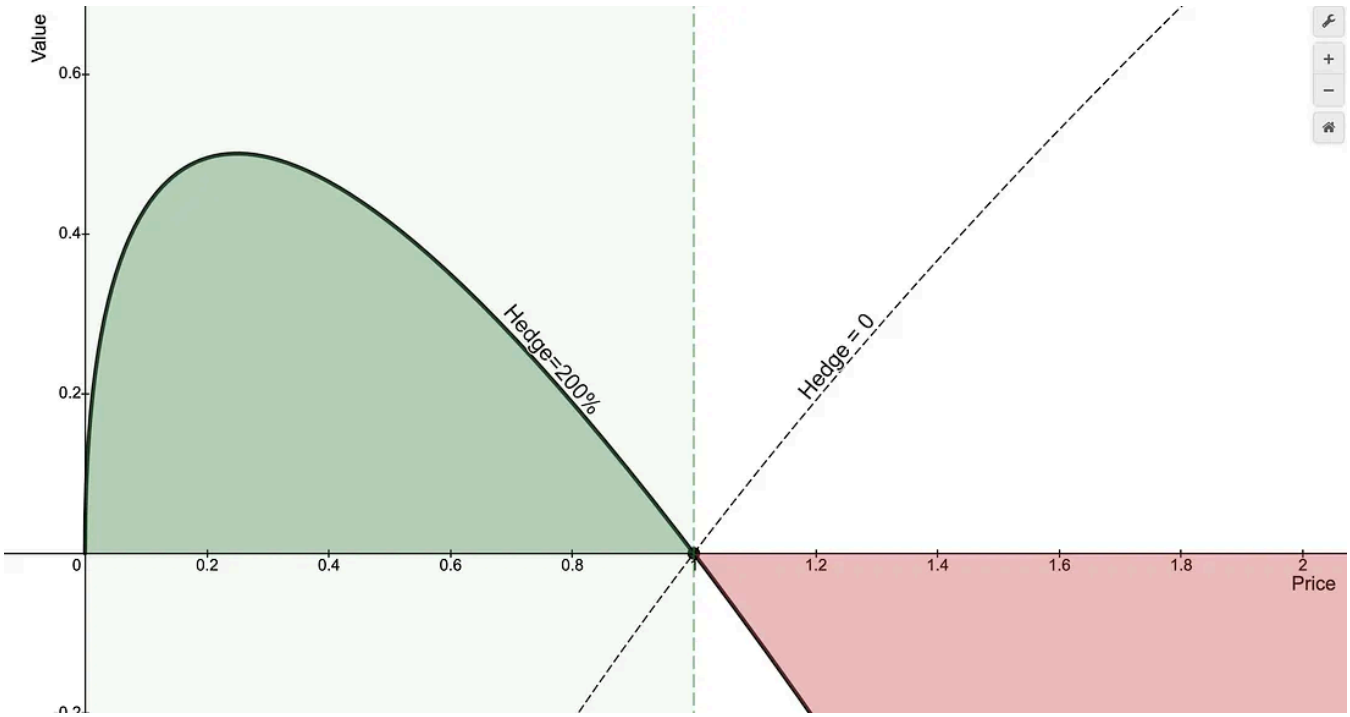
In that case, the Profit/Loss graph will not look like √price but instead be flattened out and look like this (assuming that the fees collected represent 5% of the position’s value):




Value of a delta-neutral LP position. Green region represents the profitable price ranges. Fees = 5%. https://www.desmos.com/calculator/pkscywsiiw

Thus, in a delta-neutral LP position, value accrual occurs mainly through fee accumulation and the value of the position is resilient to small price fluctuations (the position above will remain profitable despite a +/- 40% change in the asset price).

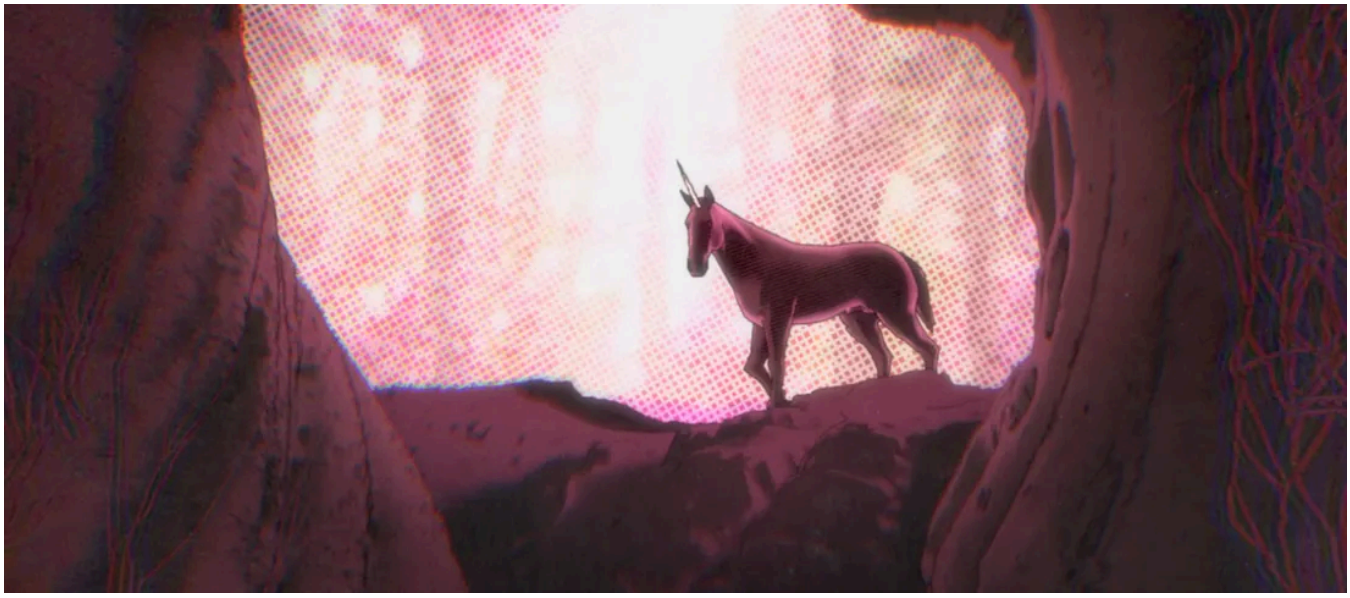
Obviously, if LPs hold a truly bearish perspective on an asset, they may even borrow more than the amount of numéraire and deploy a bearish LP position by borrowing 200% of the deposited numéraire (and selling a part of it to lock it at 50:50 ratio):




Value of a bearish LP position. Green region represents the profitable price ranges. Size of the hedge = 200% of the numéraire value. https://www.desmos.com/calculator/pkscywsiiw

Euler Finance allows users with different assumptions to still participate in Uniswap pools. As a result, LPs with a bearish assumption can still provide liquidity and will 1) collect trading fees on the way down and 2) end up with more value than they started with.

## Hedging in Uniswap v3 using Euler Finance



Delta-neutral or even bearish positions can still be deployed in Uniswap v3. While concentrated liquidity in Uniswap v3 changes the analysis somewhat, we can still easily derive the value of a hedged position as:

$$V(S) = \frac{2\sqrt{Kr}\left(\sqrt{S} - \sqrt{S_0}\right) - (S - S_0)}{r - 1} - H\,(S - S_0) + F, \text{ where: } \begin{cases} r = \sqrt{\frac{\text{priceUpper}}{\text{priceLower}}} \\ K = \sqrt{\text{priceUpper} \cdot \text{priceLower}} \\ S_0 = \text{Starting Price} \\ H = \text{Number of borrowed asset tokens} \\ F = \text{Accumulated fees} \end{cases}$$

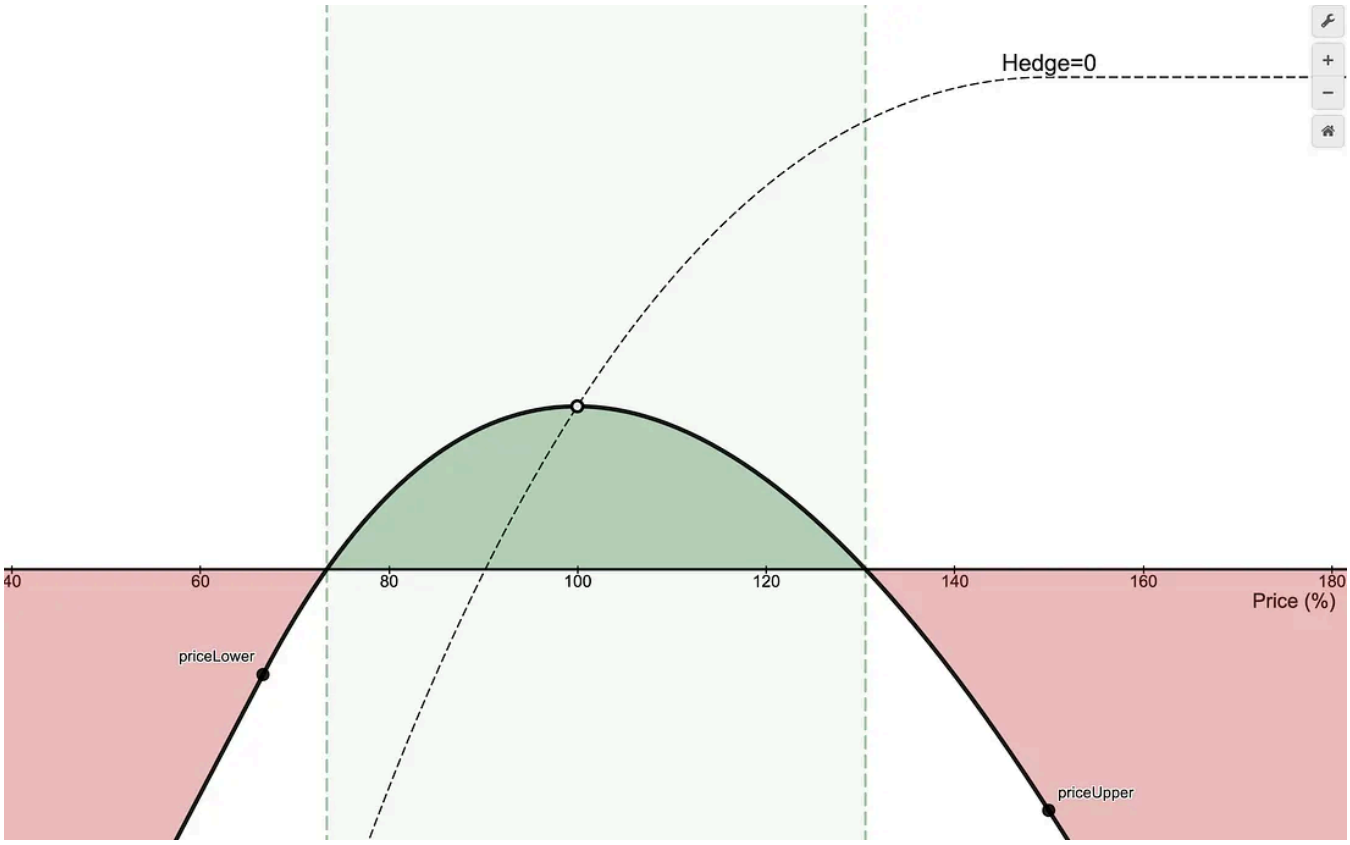
And the value of the delta for a hedged Uniswap v3 positions is:

$$\delta(S) \equiv \frac{dV}{dS} = \frac{\sqrt{\frac{Kr}{S}} - 1}{r - 1} - H$$

Hence, the amount that needs to be hedged to make the position fully delta-neutral, assuming it is centered around the strike price K, is:

$$H = \frac{\sqrt{r} - 1}{r - 1}$$

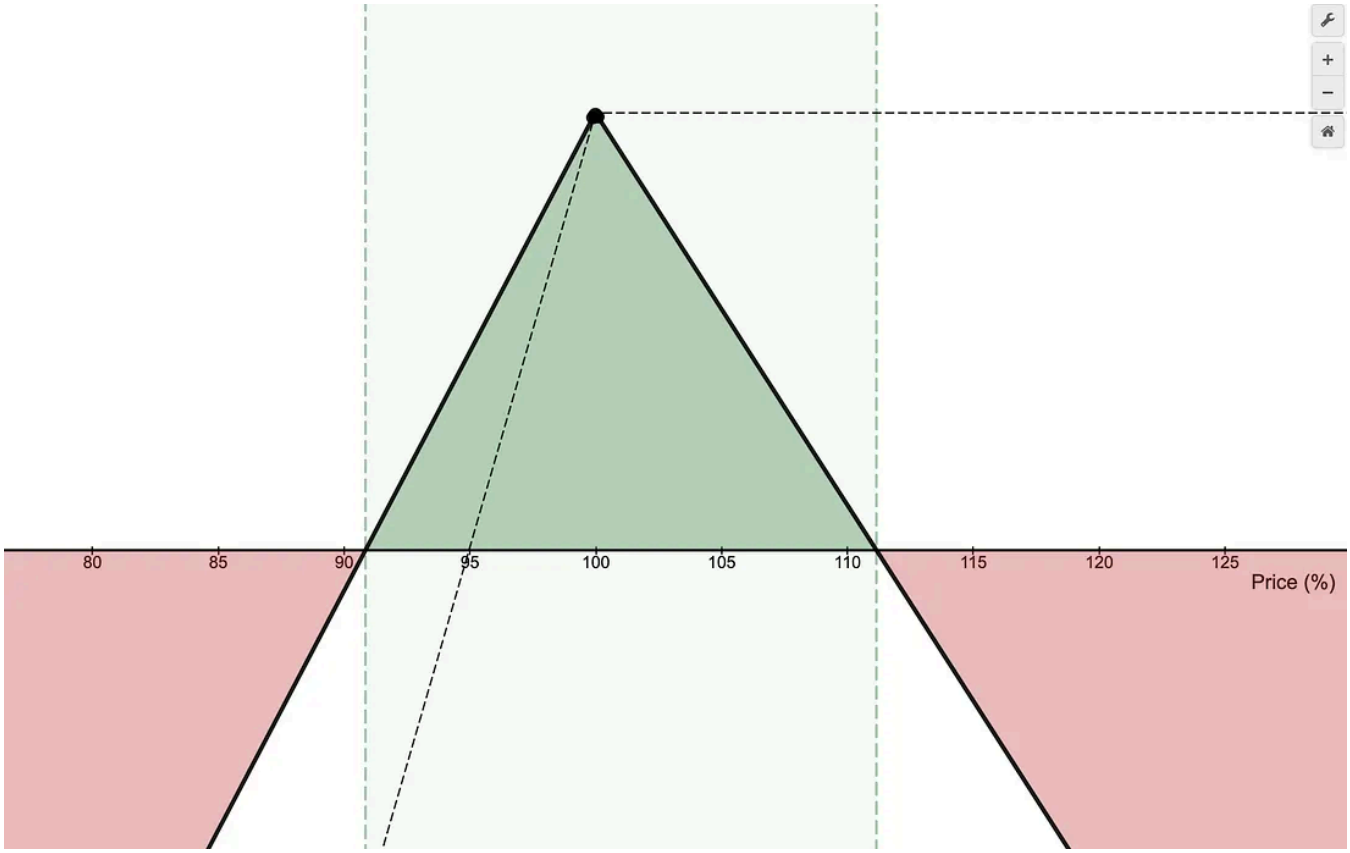
Here is how a delta-neutral Uniswap v3 position looks like (solid line) compared with one without any hedge (dashed line):




Value of a delta-neutral LP position. Green region represents the profitable price ranges. Fees = 5%, r = 1.5.
https://www.desmos.com/calculator/669zg1rmvb

Notice how the slope of the position's value is flat near the starting price. This means that the value of the LP token will not lose much value in response to +/- 25% price fluctuations.

One advantage of Uniswap v3 is its incredible capital efficiency. For instance, if we compare the Profit/Loss graph of a 1-tick wide position with and without hedging (dashed line), we see that hedging also reduces the amount that will be lost in case the price of the asset drops significantly. This can be seen visually by comparing the slope of the solid and dashed lines for Price<100:




Value of a delta-neutral LP position. Green region represents the profitable price ranges. Fees = 3%, r = 1.001.

This is because the position will not lose as much value because part of the assets have a short exposure, so the LP position would need to gain some value as the asset price decreases.

Once again, shorting an asset on Euler Finance allows users to take a directional "bet" on a token while still providing liquidity without ending up holding the bag when the price drops.

## Takeaways

Permissionlessly shorting an asset on Euler Finance will allow LPs to deploy directionally strategic liquidity positions that can remain profitable even in bear markets.

Going back to the list of long-tailed tokens available to borrow on Euler — ANT, WOO, SOS, or CVX tokens — it is not clear which of those tokens has the potential to outperform ETH over time, but my take is that many won't (not financial advice).

LPs could borrow any of those tokens on Euler Finance, deploy a bearish Uniswap LP position, and still profit even if the team rugs the protocol and the token price goes to zero.

Providing liquidity without downside risk. This is really a game changer.

Here are this post's main takeaways:

- Euler Finance allows users to incorporate short positions into their strategies in a permissionless manner.
- Euler Finance allows liquidity providers to provide liquidity in all Uniswap pools even if they hold a bullish, bearish or neutral outlook on the token.
- To establish a delta-neutral strategy, simply borrow tokens and lock them in a Uniswap pool at 50:50 ratio with ETH or stablecoin.
- For bearish LP positions, borrow tokens, sell half for ETH/stablecoin and lock them in a Uniswap pool at a 50:50 ratio with ETH/stablecoin.
- Euler Finance will ultimately benefit Uniswap because it allows LPs to deploy liquidity in all pools (and not just bullish tokens).

*If you're interested in these ideas please DM me on twitter @guil_lambert, visit http://www.yewbow.org, or send me an email to guil.lambert @ protonmail.com .*

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